INTERACTIVE VIDEOCONFERENCING IN BRITISH COLUMBIA:

Issues and Recommendations For Future Development

Report of the Provincial Learning Network Policy Working Group
December, 1999

DOC
DC
D7024
D 167
1999
c 1

LEGISLATIVE LIBRARY
VICTORIA, BC V8V 1X4

P 7074
D J67
1999
c.3

Canadian Cataloguing in Publication Data
Provincial Learning Network Interactive Videoconferencing Working Group.
Interactive videoconferencing in British Columbia

ISBN 0-7718-9567-4

1. Videoconferencing - British Columbia.
2. Telecommunication in education – British Columbia. 3. Distance education – British Columbia.
4. Open learning – British Columbia. I. Title.

LB1028.75.P76 1999 378.1'7358 C99-960422-8

The Interactive Videoconferencing Working Group was established by the British Columbia Provincial Learning Network Steering Committee as a result of the recommendations made in *Access and Choice: the Future of Distributed Learning in British Columbia*; and *Charting a New Course: A Strategic Plan for the Future of British Columbia's College, Institute and Agency System*.

This report was written and produced on behalf of the Interactive Videoconferencing Working Group for the Provincial Learning Network by the following individuals:

Authors: Robert Martin (North Island College), David Chay (Information Technology Services Division), Lois Grimshaw (Ministry of Education), Amanda Harby (Centre for Curriculum, Transfer and Technology), John Nicklin (North Island College).

Research and Writing Assistant: Norman Dolan
Layout and Design: Marion Chancellor

© 1999.
Feel free to duplicate this report or any of its contents for distribution purposes.

This document is available on the Centre for Curriculum, Transfer and Technology's website:
http://www.ctt.bc.ca/edtech/plnitv.pdf

3 3298 00228 7598

100-04763/

Executive Summary

The Interactive Videoconferencing Policy Working Group was formed in November 1998. Its mandate was threefold:

- to assess the current state and potential of interactive videoconferencing [ITV] in British Columbia in the secondary and post-secondary education sectors;
- to identify issues impacting on the use of ITV as an educational solution, and
- to make recommendations for furthering the implementation of ITV approaches to address geographic, demographic and other access constraints on learners.

The Working Group was composed of educators, administrators and technology support personnel with a diverse range of experiences using interactive videoconferencing for educational purposes. Group members brought the collective voices of hundreds of students and educators during the 1995–99 time period, to the task of creating a "snapshot" of the current state of ITV activity in British Columbia. These experiences form a solid base for planning enhanced learning opportunities, using new technological options and the capacity of the province's newly developed Provincial Learning Network.

The report includes an overview of videoconferencing activity in the province, identifies key issues and makes recommendations for improvements in four content areas:

1. Connectivity and Standards
2. Technologies and Environments
3. Administrative and Operational Logistics
4. Instructor/Student Educational Considerations

In the final section, a vision for an integrated provincial approach to ITV is presented. URLs for relevant websites on educational, technical, administrative and policy issues are included, as well as working definitions for many of the terms commonly used in videoconferencing discussion. The authors' intention was to create a planning document which could effectively address issues in a relatively complex technological medium, using language understandable to a broad cross-section of readers.

The primary target audiences of the report are educators, public policy makers and educational administrators involved in the design and implementation of ITV environments. The report is also a valuable resource for planning teams, professional development committees, and instructors with an interest in using videoconferencing as an educational solution.

I would like to thank the members of the Working Group, who made their time and expertise available despite already demanding schedules and workloads. Their generosity and commitment have produced a significant contribution to British Columbia's ability to innovate in this evolving area.

Robert Martin
Dean, Academic and Developmental Programs, North Island College
ITV Policy Working Group Chair, December 1999

Table of Contents

Executive Summary		**iii**
Introduction		**5**
Terms of Reference		**6**
Membership List		**7**
■ SECTION 1:	*An Overview of ITV Activity, and Emerging Issues in British Columbia*	**8**
■ SECTION 2:	*Connectivity and Standards*	**10**
	• Current Technologies	10
	• New Developments	11
	• Issues and Recommendations	12
	• Connectivity and Standards—Recommendations	13
	• Expected Benefits	14
■ SECTION 3:	*Technologies and Environments*	**14**
	• Suite-based and Desktop Systems	14
	• Emerging Technologies	17
	• Technologies and Environments—Issues and Recommendations	17
■ SECTION 4:	Administration and Logistics for a Provincial ITV Model	**18**
	• Scheduling Issues	18
	• Technical Support Issues	19
	• Hardware Maintenance Issues	19
	• Administration and Logistics—Recommendations	19
■ SECTION 5:	Learner and Instructor Educational Considerations	**20**
	• Historical Barriers	20
	• Current Issues	21
	• Formula Funding Disincentives	21
	• Learner Issues	21
	• Instructor Issues	22
	• Educational Considerations—Recommendations	22
■ SECTION 6:	A Vision for ITV In British Columbia in 2002	**23**
APPENDIX I:	Terms and Definitions	**25**
APPENDIX II:	Annotated Relevant URLs	**26**
APPENDIX III:	ITV Usage Questionnaire and Responses, June 1999	**29**

Introduction

The ITV Policy Working Group was established to review interactive videoconferencing activity in the secondary and post-secondary education sectors in British Columbia, and to recommend options for change and improvement as the Provincial Learning Network becomes fully operational.

Members were selected for their depth of experience in a variety of ITV environments. Instructors with over a decade of teaching broadcast and interactive video courses, technology managers who have innovated with several generations of new equipment and approaches, and administrators who have incorporated ITV into secondary and post-secondary programs successfully, all made unique contributions to the process and to this report.

The group received its mandate from, and submitted its results to the Provincial Learning Network implementation team. The report recipients were expanded to include the Standing Committee on Education Technologies [SCOET] within the Centre for Curriculum, Transfer and Technology [C2T2]; the FTE Funding Formula Review Instructional Working Group, and the Education Technologies Working Group [ETWG] mandated by the Ministry of Advanced Education, Training and Technology to create a policy framework for implementing the education technology provisions in Charting A New Course.

In order to address the full range of issues which interactive videoconferencing brings to our attention, the report draws on the terminologies of both educators and technological support staff. The working group has attempted wherever possible to explain technological issues in lay language which will be understandable to all readers. Please refer to Appendix I for definitions where applicable.

Terms of Reference

PLN ITV Policy Working Group

1. The timeline for the working group was twelve months, from October 1, 1998–September 30, 1999.
2. The working group was composed of representatives of various end-user groups, primarily the post-secondary [College/Institute/Agency sector, and University sector] and K–12 systems.
3. The working group liaised with members of the C2T2 Educational Technologies User Group listserve, and monitored this list as a reference point. A followup discussion of the report contents will take place on the list in January 2000.
4. The working group met three times in central locations. All other communications were managed electronically. Connectivity and product demonstrations were provided by the Information, Science and Technology Agency.
5. The primary functions of the working group were to:
   a. identify key issues facing users and potential users of interactive videoconferencing over the Provincial Learning Network;
   b. draw on experience using compressed and full motion ITV in the four year period [1995–1999] to outline key needs and potential service models for meeting those needs;
   c. liaise with key stakeholder groups and organizations regarding these issues; and
   d. propose strategies for developing an integrated, accessible, provincial approach to ITV, using a range of services including compressed and full motion options migrating to IP [Internet Protocol] -based where possible. These included bridging, gateway services and scheduling, and a web-based source directory.

The group submitted this report on its findings, including recommendations, as of December 31, 1999. The report will be available on the C2T2 web site in pdf format at www.ctt.bc.ca/edtech, with a file name of www.ctt.bc.ca/edtech/plnvideoconf.pdf, as of early March, 2000 .

Membership List

Provincial Learning Network Interactive Videoconferencing Policy Working Group

Robert Martin [Chair]
Dean
Academic and Developmental Programs
North Island College

Rick Ashe
Principal
Cataline Elementary School
Cariboo/Chilcotin District

Heather Schneider
Senior Instructional Officer/Dean of Instruction
College of the Rockies

Michael Keating
Manager
Education Services
University of Victoria

Adrian Kershaw
Vice President
Distributed Learning and Community Education
University-College of the Cariboo

Dr. Michael Catchpole
Faculty Member/ITV Instructor
Humanities and Social Sciences
North Island College

David Chay
Interactive Communications Analyst
Information Technology Services Division
Information, Science and Technology Agency
of British Columbia

Amanda Harby
Manager
Educational Technology
Centre for Curriculum, Transfer and Technology

Lois Grimshaw
Chair
Government Videoconferencing Users Group
Ministry of Education
Province of British Columbia

John Nicklin
Associate Dean
Instructional Resources
North Island College

Rick Withers
Manager
Education Technology Branch
Ministry of Education
Province of British Columbia

REPORT ASSEMBLY/EDITING: Norman J. Dolan
LAYOUT/PRINT MASTERING: Marion Chancellor
ADMINISTRATIVE SUPPORT: Kristie Schrader

Section 1 An Overview of ITV Activity, and Emerging Issues in British Columbia

This section offers a short overview of videoconferencing methods and activity in British Columbia during the 1995–1999 period, and identifies key issues which have emerged in educational trials and course deliveries during that time.

Charting a New Course, the strategic plan for the B.C. College, Institute and Agency sector introduced in 1996 [http://www.aett.gov.bc.ca/strategic/], identifies appropriate use of evolving education technologies as a key strategy for addressing the four requirements of access, relevance and quality, affordability, and accountability. The provisions and recommendations of Charting a New Course which deal with education technologies, have had a policy framework developed by a MAETT-sponsored working group. The reports of this working group can be found on the internet at http://www.aett.gov.bc.ca/strategic/edtech/part2/welcome.htm

The concept of cross-regional programs and services offered to students with the teaching and programmatic resources of several partnering institutions, holds unique promise for addressing these requirements. For this promise to be realized, however, British Columbia's educational institutions need access to a standardized system which can deliver acceptable quality levels throughout the province. This is the mandate of the Provincial Learning Network. This report identifies a number of issues requiring resolution if the PLN is to enable linked interactive classrooms and desktops to function effectively as part of that system.

Interactive Videoconferencing [ITV] is a relatively new phenomenon in British Columbia schools, colleges and universities. The capacity to link classrooms equipped with cameras, microphones and televisions so that learners in two or more locations can see, hear and speak to each other or their instructor, has only been available for five years. This approach is commonly referred to as *suite-based* videoconferencing. *Desktop* videoconferencing, in which individual users can see and hear one another on networked computers, has been used less for instructional purposes to date. The evolution of IP [Internet Protocol] based videoconferencing, with its promise of ubiquitous toll-free connectivity, offers significant advances in both modalities.

It's nice to be here with all of you.

DR. STEPHEN HAWKING, from Science World, Vancouver connected to multiple ITV sites across the province by downlink June 1993

Prior to 1995, the Knowledge Network offered a one way video/two way audio option. This approach, also pioneered in U.S. states including Maine and Oregon, delivered broadcast educational television to receive sites via cable service, satellite dishes or microwave connections. Learners at receive sites were able to telephone the source site, but could not be seen by their counterparts in other sites. The approach received mixed reviews in terms of pedagogical effectiveness, the costs of production, and the expense of satellite connectivity. Its utilization has declined over time for these reasons, and because of the advent of two-way interactive ITV.

By 1994/95, full two-way interactive videoconferencing options became available as technologies improved. Telecommunications advances made it possible to send both audio and video signals over digital networks, in two formats; *full motion*, or "living room" quality television, and several levels of "*compressed*" ITV. The major difference between the two approaches is the *bandwidth* required to deliver audio and video signals simultaneously, between two or more sites.

Full motion videoconferencing was made available in 1995 by Telus, formerly B.C. Tel, under their premium quality Ubiquity program. Community Connections, a Telus initiative set up to market this service to the educational and business communities, was an early partner in educational trials funded through the B.C. government's Innovation Fund. Connecting sites with Ubiquity full motion service requires a fibre-optic link. These links have largely been available in urban centres in the province, including the Victoria, greater Vancouver, and the Kamloops and Prince George regions

The price structure offered by Telus was not conducive to volume use by the majority of institutions which had access to it. UBC, SFU, UNBC and the University of Victoria have not expanded their full motion programming to provide mainstream educational opportunities, largely because of the cost. Government policy requiring that base funding for such activity would have to come from internal reallocation, during a period of increasing student demand and frozen tuition fees, has also resulted in a minimal level of implementation. The Ubiquity program was withdrawn in September of 1999, and replaced with a new option requiring lower bandwidth. Pricing structures from Telus, however, have not changed to levels which offer affordable connectivity to educational volume users.

I enjoyed the opportunity to have contact with the instructor directly through interactive video. I was able to stay on track this way—I lack the "stick-to-itiveness" to complete correspondence style distance education courses. The connection between students in classrooms made a huge difference to me.

College of the Rockies Student
May, 1999 three-way pilot delivery between North Island College, the University of Victoria, and the College of the Rockies

Compressed videoconferencing uses digital telecommunications services over existing copper telephone lines. Digital services such as ISDN Basic Rate Interface and Datadial56 are available in many areas of the province. One standard ISDN channel or DataDial56 line carries 56 or 64 kilobits (k) of data each second. Using network devices at videoconferencing sites, it is possible to group channels together to offer sufficient bandwidth for audio and video signals to travel back and forth at a constant rate. The fewer the number of channels used, the lower the quality of signal. Two channels make it possible to do ITV with a 112k bandwidth. At this level, any movement of subjects on camera appears jerky and somewhat unnatural, and results in "smearing" of the visual image. It is similar to the video pictures sent back to earth from the early NASA space missions. Resolution is diminished, and there is a time lag when conversing with another site.

For five years, differing levels of compressed ITV have been the only option available to many BC communities. 112k, 224k and 384k activity has grown slowly as governments have used ITV for administrative and training purposes, and educational users have delivered courses within and across geographical regions of the province. Impediments to increased use have been the significant costs of multiple long distance tolls for each call, limited availability of ISDN and DataDial56 services, lack of adequate training for users, and lack of standardization in equipment and protocols for transparent connection.

Additionally, issues identified in the Policy Forum on Distributed Environments in 1995 [http://www.ctt.bc.ca/edtech/policy/toc.html], including the need for a shared FTE funding formula, and the need for a registration system which allows learners from different educational sectors or geographical regions to enroll in a course through one standardized mechanism, remain unaddressed. It is hoped that the policy frameworks developed by the MAETT Education Technology Working Group, and the MAETT FTE Funding Formula Review, will provide solutions in these areas.

Delivery trials have also experimented with "bridging" the Ubiquity and compressed formats through a gateway. The only *gateway*, the equipment which can perform this function, is owned by Telus. Its use adds expense and scheduling complexity to room connections.

A significant resource for educational videoconferencing users in British Columbia during its early developmental period has been an online listserve run by the Videoconferencing Users Group, supported by the Standing Committee on Education Technologies out of the Centre for Curriculum, Transfer and Technology. Over 20 institutions participated in an audio conference in October 1997 to discuss activity levels and emerging issues. At that time, the primary disincentives identified were unsustainable connectivity costs, lack of a systemic approach to professional development , and inadequate technical support.

A more recent survey carried out by Amanda Harby of C2T2 in May 1999 revealed that these constraints had not changed significantly. The survey questionnaire, and collated responses from 28 organizations which responded, is included in this report as Appendix III.

The survey results reinforced the preliminary findings of the working group. Issues and constraints in using ITV fall under four main categories: Connectivity and Standards, Technologies and Environments, Administrative /Operational Logistics, and Instructor/Student Educational Considerations. Each of these areas will be addressed in detail in this report.

Section 2 Connectivity and Standards

This section examines two significant technological issues that have impeded the deployment of interactive videoconferencing—connectivity and interoperability.

Connectivity refers to the capacity of videoconferencing systems at different sites to be linked in order to create a network. *Interoperability* describes the extent to which the operation of those systems can be coordinated in a way that enables users to interact successfully with one another.

Both of these issues play a vital role in the successful development and implementation of a viable videoconferencing network. Connectivity is explored from the perspective of issues that limit the implementation of videoconferencing to date. Interoperability is examined from the point of view of the operating standards that require further definition, and agreement from end users.

Current Technologies

As of September 1999, there are over fifty videoconferencing facilities at various educational institutions and facilities in the province. The majority of these sites use compressed videoconferencing based on the ITU-T H.320 Standard. The remaining sites have used the Telus Premium Ubiquity Videoconferencing Service. Many other communities do not have videoconferencing due to the lack of telecommunication facilities required to support current videoconferencing technologies.

Systems based on the ITU-T H.320 Standard require a circuit-switched network like ISDN or Datadial56 service from the local/regional telecommunications provider. Typically, two to six channels are used to establish an H.320 videoconference connection. Connections are initiated in a fashion similar to placing a telephone call using a keypad. H.320 videoconference systems use various techniques to compress audio and video for sending across the circuit-

switched network to another system where the sounds and images are decompressed. Using two to six channels, connection speeds from 112 kilobits per second to 384 kilobits per second can be established for the videoconference. Because these systems use the circuit-switched network, the initiated connection speed is dedicated to the conference for the duration of the conference. No other data flows over the circuits at the same time, and users pay long distance tolls for each of the dedicated connections.

H.320 systems can connect with one another as long as they are on a compatible circuit-switched network, in-province, out-of-province and internationally. Again, this is very similar to a telephone connection. The operational cost, however, is a multiple of the number of circuits in use as compared with a telephone call. This means H.320 calls cost two to six times the long distance toll —depending on the number of channels in use. This becomes very costly if videoconferencing is relied on heavily for class or service delivery.

Overall, the performance of an H.320 videoconference is in the low to moderate range—again depending on connection speed. Various organizations have experienced differing degrees of success using this approach. With ongoing improvements to compression algorithms and hardware compression devices, the performance of H.320 videoconferencing systems continues to advance allowing better quality audio and video in the same amount of bandwidth.

The Ubiquity Premium Videoconferencing Service has been available only at locations served by the Telus Ubiquity Network. It is a proprietary videoconferencing service and requires a large bandwidth (in excess of 20 megabits per second) to conduct a videoconference. As previously mentioned, a specialized gateway is required to inter-operate with H.320 compressed videoconferencing sites.

Telus's Premium Videoconferencing Service offers high quality, full motion video. The drawbacks are the ongoing operational costs, the low quantity (one) and low quality of gateways to H.320 systems, and the limited number of sites that can access the service. A credit course trial in the 1997/98 academic year [University of Victoria, University-College of the Fraser Valley, North Island College: Child and Youth Care programs], funded by the Ministry of Advanced Education, Training and Technology in partnership with Health Canada, demonstrated some improvements over time. However, the connectivity costs of the gateway and Telus bridge were considered unsustainable as a long-term cross-service solution.

New Developments

The fast growth of the Internet and the Internet Protocol (IP) has had a positive impact on videoconferencing. With the far reach of the Internet and the standardization of video protocols for IP networks, there is potential for videoconferencing in regions where it has not been previously available. The following points describes potential technology advancements that will allow this to happen:

2.1 ITU-T H.323 Standard for Videoconferencing over IP is in its second release and continues to undergo refinements. This standard sets the stage for interoperability amongst products and services from different manufacturers and vendors. The standard also promotes interoperability from an end-user perspective. Without standardization, there will be no guarantee of interoperability within or between organizations.

2.2 In general, the Internet is available throughout the province. However, limited availability of bandwidth across the Internet will prevent the fast proliferation of videoconferencing over IP. Over time, communities will continue to be upgraded with more bandwidth as new technologies are deployed. ADSL, cable, fibre, satellite are a few examples of network technologies that are aggressively being deployed to enable higher bandwidths for communities.

2.3 Quality of Service (QoS) is major issue for the deployment of IP videoconferencing services over a converged data, voice and video network. QoS protocols guarantee the level of quality of the audio and video in a videoconference. These protocols are still under development but are anticipated to be available in the next 18 to 36 months.

Other potential factors that can have a positive impact on the establishment of videoconferencing in the province include:

- Lower long distance toll rates for ISDN and Datadial56 usage.
- Better availability of ISDN services from telecommunication providers
- Improved audio and video compression standards
- Flexible systems optimized for performance and ease of use
- Lower total cost of ownership

Issues and Recommendations

The successful of deployment of videoconferencing throughout the province, is dependent on addressing the following connectivity/standards issues:

2.1 Current level of connectivity through the circuit-switched network (ISDN and DataDial56) is insufficient to support videoconferencing. Many communities do not have access to ISDN or DataDial56 required for H.320 type videoconferencing.

2.2 Current cost models such as ISDN long distance tolls that are charged by the minute provide a price barrier, especially to smaller and more remote sites.

2.3 Videoconferencing through the Ubiquity network has been proprietary, costly and lacks interoperability with standards-based videoconferencing technologies.

2.4 The level of functional interoperability among videoconferencing sites in the educational community is low.

2.5 New technology that allows videoconferencing over IP is just becoming available. There are a number of challenges to be met before a provincial implementation strategy can be put in place.

2.6 Significant investment in both Ubiquity and H.320 systems has already been made by some institutions, and converting to a new technology will be costly as new equipment will be required.

2.7 Communities that do not currently have access to videoconferencing are typically located in remote regions of the province where social, educational and health services common to urban centres, are generally not available. This in turn creates a higher need for videoconferencing options to gain access to educational options available in the better-served regions. The remote setting of these communities also affects the availability of telecommunications facilities (including ISDN) that are required for video-

conferencing. Satellite communications are available, however, they are very costly and there are not many sites that have the funding to establish the necessary uplink and downlink connections simultaneously.

Connectivity and Standards—Recommendations

Recommendation 2.1
The Network Services group of the Information Technology Services Division, ISTA will evaluate and recommend new technology standards and network protocols that will allow videoconferencing to capitalize on the extensive deployment of the Internet Protocol (by April 2000).

Recommendation 2.2
The Provincial Learning Network Implementation Committee, in partnership with educational stakeholders and the Network Services group of the Information Technology Services Division, ISTA will undertake a technology pilot project to determine the viability of videoconferencing over IP. If successful, the PLN will initiate the implementation of an IP videoconferencing solution at core locations where adequate bandwidth is readily available (by September 2000). This service will be extended to other regions as bandwidth becomes available and Quality of Service Protocols are established (by August 2001).

The unreliability of the connection with other sites resulted in the class often abandoning the interactive part of the class, and focusing on a self-generated project or topic. There was initially some hesitation on the part of some students to push microphone buttons so they could participate. Over the duration of the course, the quality of the connections and comfort level of learners improved considerably.

ABBOTSFORD STUDENT EVALUATION COMMENTS
1997 Ubiquity pilot delivery
University-College of the Fraser Valley, University of Victoria, North Island College

Recommendation 2.3
The Provincial Learning Network Implementation Committee, in partnership with educational stakeholders and the Network Services group of the Information Technology Services Division, ISTA, will develop a heterogeneous videoconferencing network that will allow H.323, H.320, full motion videoconferencing and possibly other videoconferencing technologies to fully interoperate with each other, by

- Continuing to research and test H.323 products as they become available (by August 2000)
- Working with Telus to identify and address gateway issues between the successor to Ubiquity Premium Service and H.320 (by April 2000).
- Integrate networks using H.323, H.320 and the successor to Ubiquity through the use of gateways and bridges, if economically and operationally justifiable (by August 2001)

Recommendation 2.4
The Provincial Learning Network Implementation Committee, in partnership with educational stakeholders and the Network Services group of the Information Technology Services Division, ISTA will investigate the use of wireless and satellite communications for connecting sites that have a high requirement for videoconferencing but lack traditional terrestrial links capable of reasonable quality videoconferencing (by January 2001).

Recommendation 2.5
The Network Services group of the Information Technology Services Division, ISTA will recommend the method for provisioning resources such as multipoint bridges, gateways and directory services to optimize bandwidth utilization and minimize costs (by August 2001).

Recommendation 2.6
The Network Services group of the Information Technology Services Division, ISTA will investigate the use of real-time video-distribution technologies for streaming video and other applications that don't require the full interactivity of two-way videoconferencing (by January 2000).

Expected Benefits

- Complete interoperability between legacy and new videoconferencing systems regardless of transport infrastructure or technology standards.
- Convergence of the data and video network could reduce ongoing operational costs for videoconferencing.
- Convergence will also enable more communities to partake in videoconferencing.
- A heterogeneous network that supports legacy technology and emerging technologies will protect the current investment and capitalize on the existing installation base.
- Wireless and satellite connectivity for videoconferencing will enable very remote communities to access services through the use of videoconferencing.
- The benefits of real-time video-distribution:
  —Transmits higher quality video to larger distributed audiences
  —Uses bandwidth more efficiently
  —Lower operational costs to multiple users

Section 3 Technologies and Environments

Videoconferencing in British Columbia's secondary and post secondary institutions has developed along two distinct paths. These are high bandwidth, full motion Ubiquity; and compressed video using the H.320 standard. This duality has created interconnectivity problems which have only been partially resolved by a gateway system provided by Telus. Emerging standards such as H.323 are opening the door for desktop videoconferencing as a partner in the technology mix that currently exists. Protocols and devices are available to bridge all current videoconferencing standards.

Suite-Based and Desktop Systems

Suite-based systems [classrooms utilizing multiple microphones for students, multiple cameras and other input devices including digital data projectors and computers] provide group videoconferencing capability typically used to connect classrooms within or between institutions. The equipment used in such rooms is "standards based", using either the Ubiquity or H.320 protocols. Such equipment is capable of supporting the larger monitors needed in the classroom environment. Suite-based systems have been used extensively for teaching/learning (classroom, lecture and seminar).

Secondary uses of suite-based systems include student support and student services functions; intra- and inter-institutional meetings to reduce travel costs or provide short-notice attendance from remote locations; and as a platform for professional development for faculty and staff. Videoconferencing suites oper-

ated by the K–12 and post-secondary systems have also been made available on a rental basis to government ministries and non-profit organizations for training and administrative purposes.

Recent developments in TCP-IP based videoconferencing protocols hold promise for greater suite-based connectivity options at lower cost to the institutions involved. These advances allow classrooms to connect their audio and video systems through computers over the internet, alleviating the need to pay long distance tolls which have made videoconferencing unaffordable to many organizations in the province.

Desktop videoconferencing has developed from proprietary systems such as Cu-SeeMe. Recently, standards have been developed and adopted to unify the protocols used by desktop video systems. Hardware and software development have resulted in significant quality improvements in this medium, although the overall quality is still not suitable for anything beyond the one-on-one desktop conference. While classroom-based applications for group meetings and graduate or doctoral oral examinations have taken place in several organizations, the general consensus among instructors and technical staff has been that the quality of audio and video transmission is marginal or inadequate for multiple-classroom teaching.

Room Design

Room design is critical to the effective use of videoconferencing in the classroom. Lighting and audio are the two most critical factors in the success of educational videoconferencing.

Lighting must be such that all areas of the room are lit evenly with no hot spots or significant shadowing. Lighting design should be given high priority in the creation of a videoconference suite. Due to the variability of physical room layout, no one lighting solution is likely to apply to all locations. The choice of light source is an important one. Cool sources such as fluorescent bulbs may be preferable to hot sources such as halogen or standard incandescent bulbs unless spot lighting is required. In rooms with little or no air exchange or air conditioning, cool light sources are preferable to hot sources for obvious reasons of heat loading.

Fluorescent lighting with adequate diffusion provides balanced lighting that does not cast sharp shadows. This makes fluorescent lighting desirable for filling rooms with light, also making fluorescent lighting very non-dramatic. Where dramatic effects are desired, such as in lighting the main speaker, directional light sources like halogen bulbs may be preferred, where issues of heat loading can be effectively minimized. It should be noted that in many cases, videoconferencing rooms have been modified standard classrooms where lighting is inadequate. Retrofitting these classrooms for videoconferencing purposes has been costly, and in many cases lighting has been a secondary consideration. The quality of video signals sourced from these rooms is subsequently compromised.

Audio is the second prime consideration in the design of an effective videoconference suite. In some regards, audio design is more important than lighting or camera location. If the audio is not clear and of high quality, users of the suite will experience fatigue, and necessary information will be lost. Repeatedly, ITV evaluations have emphasized that adequate audio is a start point for student and instructor acceptance of videoconferencing as an instructional option.

Room design should take into account the acoustic qualities of the suite to minimize or eliminate echo through the use of soft surfaces such as drapes or

Giving the learners access to equipment early in the course made us much more comfortable with the environment. Each of us took turns controlling the camera angles, and the instructor and other learners in Victoria made us feel like part of a regular class. This was the only way I was able to get access to this kind of course.

KAMLOOPS STUDENT EVALUATION COMMENTS
University College of the Cariboo Human Services Program/University of Victoria School of Child and Youth Care, pilot Ubiquity delivery, 1996

sound absorbing panels. The microphones provided as standard equipment with most videoconferencing systems are often unsuitable for the educational videoconference suite, in number, quality, or signal mixing. Affordable after market push-to-talk microphones and noise cancelling pre-amplifiers have been used successfully in a number of ITV classrooms to ensure high quality sound broadcast. Good quality amplifiers and speakers are a necessity in reproducing high quality audio at the receiving ends. Speaker placement should be designed to provide even coverage of the room with no dead spots, and avoid feedback loops. Instructors who have been provided with wireless lapel microphones to ensure that sound levels do not change as they move around the classroom have reported clear increases in learner satisfaction at receive sites.

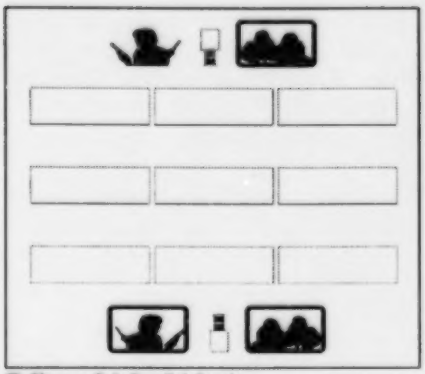
Camera type and placement is the third critical factor in room/system design. Cameras capable of following the instructor automatically are desirable in most systems, minimizing the need for a technician to pan and tilt the camera remotely in situations where the instructor is not teaching from a static position. Devices that locate and zoom in on other speakers either through sound triangulation or by the push-to-talk switch on a microphone may be desirable in some rooms.

The use of automatic pan-tilt-zoom cameras in compressed systems running at less than 224kbps may not be desirable due to "image smearing", as video compression breaks up the video signal when movement occurs. In these cases a camera operator may be used to advantage to move the camera when needed, or to switch between camera sources as required. The University College of the Cariboo has had success with stationary table and microphone designs, where students are taught early in a class to provide camera steerage for their site. Learners have adapted to this task without claiming undue additional responsibility.

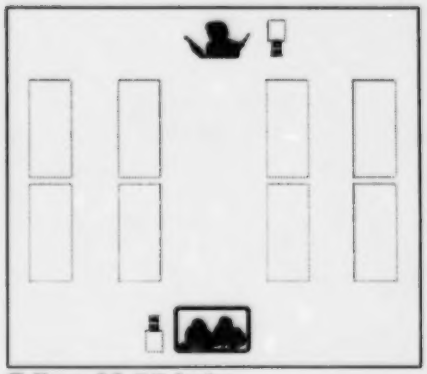
Suites should be configured with at least two cameras plus a document camera where possible. A main camera is used to follow or zoom in on the main speaker and a second camera is used to locate and zoom in on class participants as they participate. This reduces off-camera learner participation at remote sites, image smearing and wear on the camera's mechanisms.

While seating arrangement, and hence table/desk arrangement, is somewhat determined by individual instructors and learning style requirements, allowances for reconfiguration of seating must be moderated by the requirements for lighting, audio quality and camera visibility. Seating arrangement is affected by monitor placement. In rooms where monitors can be ceiling mounted, the video feed from near and far ends can be shown at the front of the room for the benefit of the class participants and at the back of the room for the benefit of the instructor or main speaker. This video presentation layout allows for seating to be provided in rows parallel to the front of the room (see Figure 3.1). Where monitors cannot be located in the front and rear of a room, seating must be located such that the class participants can see clearly both the main speaker and the remote class.

An alternate seating arrangement, proven to be effective in practice by North Island College, is the "U" arrangement where students can see and be seen (See Figure 3.2). This seating arrangement provides the student with a clear view of the remote monitor and the instructor and facilitates interaction between sites. In rooms that are designed primarily as receiving sites, monitor placement is usually confined to the front of the room. Monitors should be of sufficient size that they can be seen clearly from all parts of the room, and that mid-size group shots do not make facial features indistinguishable.



■ **Figure 3.1** Parallel Seating



■ **Figure 3.2** "U" Seating

Alternatively, several monitors may be provided to achieve the same end. Monitor size can prove to enhance or diminish the overall ITV experience for faculty and students alike. Experience (at NIC, UVic and elsewhere) has shown that very large monitors in the 45" to 52" range can dramatically improve the overall visual effect of ITV by increasing the ability to recognize facial expression when cameras are zoomed out to afford a group shot. With systems which allow for multiple classroom views in a split screen format, large monitors are particularly effective.

Suite design should provide for flexibility in the options available for the videoconference. In conferences where the main speaker is controlling the equipment, the control panel must be located on a desk or podium that is immediately available to the speaker. In conferences where an operator or technician is controlling the system, the control panel must be located in a convenient location for the technician, one that is unobtrusive and will not interfere with the conduct of the class. Technician space may be within the classroom itself or in an adjoining control booth if physical parameters allow, although students and instructors have voiced concerns in evaluations regarding the feeling of intrusiveness when technicians are active in the classroom.

Emerging Technologies

The growth of the World Wide Web and the ability to deliver information in various formats through web-based systems have extended the possibilities for videoconferencing. Streaming video systems allow video and audio to be captured and transmitted live through the Internet to a web browser or streaming video player. Alternatively, video and audio can be digitized and stored on disk for later retrieval through a web site. The advent of PLNet has made it possible to integrate streaming video into the videoconferencing arena. Audio and video streaming increase the options for one-way participation of learners with recorded media, but do not allow the same level of interactivity as a live multisite classroom environment.

Technologies and Environments—Issues and Recommendations

Issues

3.1 Ensuring a standards-based system. Standards exist for ITV equipment and transmission protocols. Adherence to these standards is critical in building

a non-proprietary province-wide system. Designers should keep in mind that while proprietary codec protocols may deliver superior audio or video, they will only do so when connected to a similar proprietary system and that such protocols are not standards-based.

3.2 Flexibility of classroom layout in the videoconferencing suite to suit the needs of faculty and students. Many institutions do not have sufficient classroom space to provide dedicated ITV-only use. Guidelines are required to outline the factors necessary for an optimal ITV environment in multipurpose rooms.

Recommendations

3.1 The PLN Steering Committee will establish a provincial ITV Standards Group[1], which will produce a set of standards to ensure interconnectivity. The ITV Standards Committee will ensure that all PLNet and partnering organizations are made aware that equipment must meet these ITC H.323/H232 standards before it is leased or purchased. ITVSC established and standards developed by September, 2000. Information sharing, ongoing through the ETUG listserve operated by C2T2.

3.2 All participating organizations will ensure that room design allows for flexibility of seating within the constraints of room wiring.

3.3 Room designers at participating institutions will ensure that seating is designed to allow all participants a clear view of the system monitors and unobstructed access by room cameras. Design guidelines will be provided by the Provincial Learning Network Implementation Committee as outlined in 3.1.

Section 4 Administration and Logistics for a Provincial ITV Model

Issues requiring resolution in this section include scheduling, adequate technical support, and hardware maintenance.

Scheduling Issues

There are two separate booking systems for videoconferences that are currently in use in B.C. The first system requires that each site be contacted by telephone to schedule the necessary room and equipment. The alternative system involves telephoning or faxing a room broker, and paying additional scheduling fees, in addition to a premium on room rates to have the broker schedule the videoconference. The following problems are known to occur within either system:

- videoconference sites have been known to lose bookings if they are made too far in advance;
- out of province room brokers use eastern time zones which causes confusion for sites in BC;
- scheduling facilities within the time zones in BC can also be confusing for some sites.

Desirable features in a scheduling system would include the ability to schedule any room in the province, the ability to check calendars, provide an esti-

[1] Membership for this working group should be drawn from the Educational Technology Specialists Group which has membership from all colleges and institutes. Additional membership should be drawn from the University and K–12 sectors.

mate of costs, and provide detailed information on facilities at each site. New generations of IP-based gatekeeper software include scheduling options which may address these issues.

Technical Support Issues

The videoconference industry is still quite young; in many cases, minimal training opportunities have been available. As a result, many staff members operating videoconference sites have received little or no training and are not able to perform a minimum of troubleshooting on their equipment. Technical support staff demands for a growing range of services make it impossible for them to be present all the time as videoconferencing activity increases.

In the worst-case scenario, staff with little or no experience in dialing out are only able to power up the codec and monitors. They have to wait for a multipoint bridge to connect them, and to perform other basic operations. The impact of this limitation on clients is significant. Some have commented that they will never use videoconferencing again, after experiencing any type of technical difficulties with previous generation compressed systems. With the new generations of IP-based systems such as those produced by Polycom, the user interface is simple and intuitive, requiring less ongoing technical support. A hand-held remote allows users to set up automatic dialup memories, create zones for voice-activated camera tracking, and connect calls with the push of a single button.

Hardware Maintenance Issues

The majority of videoconference sites in BC do not have agreements in place for the provision of hardware maintenance. When equipment fails it has to be shipped to a vendor. Depending on the nature of the problem, it may be weeks before the equipment is returned and repair costs can be high. When this fact is combined with the problem of staff members at videoconference sites having little or no troubleshooting experience, even simple failures such as a microphone that is not plugged in securely, can result in a site being inoperable for extended periods.

I enjoyed the group activities, they get everyone involved in some positive interaction. Most night classes I tend to find boring and get tired, but this is the first one that has kept me interested, even talking with other students on television.

VICTORIA STUDENT,
1995 UBIQUITY PILOT DELIVERY
University College of the Fraser Valley/University of Victoria

This in turn impacts the entire delivery system. When clients cannot count on a site to be operational for their videoconference, or when students struggle through a videoconference class being led by someone in 'lecture-mode' instead of using the technology to its fullest, future videoconferencing experiences are less likely to be seen positively. Students at several institutions who have had poor experiences with initial classes are therefore reluctant to register in subsequent ITV courses, even when they are the only option for increasing access in their locations.

The time and resources required to support ITV have often not been a top organizational priority. Without the strong support of the organization's leaders, it is next to impossible for the organization to achieve the potential benefits of videoconferencing.

Administration and Logistics—Recommendations

4.1 The BC ministries of Education and Advanced Education, Training and Technology work with institutional and private sector partners to develop

an online web-based system which ITV schedulers can access, by September 2000. (see http://www.adcom.ca/Our_Services/Reservations/Conference/conference.html and http://www.vitlink.org/ —select 'Bookings', also sitlink.org/ —select 'Bookings', as examples.)

4.2 The Ministry of Education approach Royal Roads University to develop courses for K–12 and post-secondary facilities in-province to address: site operation (administration, booking, videoconferencing protocols), technical support, conference facilitation, and delivering via videoconferencing (for trainers and presenters), for delivery by September 2000

4.3 The Ministry of Education will enhance the website at www.videoconferencing.gov.bc.ca to provide basic online technical support by January 2000

4.4 The Provincial Government will explore the potential for a province-wide maintenance agreement for public sector sites (education, government, skills centers, etc.). Volume discounts may apply.

4.5 The BC Government Videoconference Advisory Group will work with the BC education community to create events such as the Virtual Open House to showcase the technology on a regular basis [ongoing].

4.6 The Centre for Curriculum, Transfer and Technology develop and deliver professional development activities that use videoconferencing as delivery mechanisms where appropriate.

Section 5 Learner and Instructor Educational Considerations

Historical Barriers

The majority of interactive videoconferencing course delivery in British Columbia between 1995 and 1999 has taken place in the College, Institute and Agency sector. While the four main universities have all had access to Telus Ubiquity full motion service, the cost of connectivity and systemic barriers to cross-sectoral deliveries have resulted in a minimal level of activity. The lack of fibre optic access to most rural college regions also meant that the compressed videoconferencing piloted by North Island College, College of the Rockies, Capilano College, Selkirk College and a number of school districts, had to be "translated" by the Telus gateway to connect with the Ubiquity system. This service added expense and technical difficulty, further inhibiting cross-sectoral activity.

The most active institution using ITV in British Columbia is the University College of the Cariboo. Its delivery levels have been maintained by an administrative decision in 1995 to allocate the majority of its Innovation Fund financing to ITV capital allocation; its access to full-motion Ubiquity service throughout most of its service region; and its decision to allocate base funding for connectivity.

Data from a number of ITV evaluations done on pilot deliveries between 1995–1999 is available from the website maintained by the Education Technology Group of the Centre for Curriculum, Transfer and Technology. [http://www.ctt.bc.ca/edtech/videoresources.html]

Current Issues

The survey on ITV activity carried out by the Centre for Curriculum, Transfer and Technology in May, 1999 offers a snapshot of current issues, in Appendix III of this document. The survey identifies the following major constraints for organizations wishing to adopt ITV teaching options:

- lack of dedicated institutional resources for dedicated ITV rooms and connectivity;
- lack of coordinated cross-sector professional development resources; and
- lack of a standardized approach to classroom configuration, connectivity, registration and fee collection.

Formula Funding Disincentives

Another systemic issue is the disparity in the current FTE funding formula used by the Ministry of Advanced Education, Training and Technology . The variables in the formula offer no designated funding options which support cross-regional or cross-institutional deliveries. For rural regions particularly, ITV could make the educational assets of the urban areas available to small groups of learners whose numbers are insufficient to warrant traditional teaching methods. A revised funding formula with provisions to share FTEs would be required to do this.

Learner Issues

First-time learners in ITV classrooms require adequate orientation to equipment and new teaching approaches. Instructors, particularly those who are new to the technology and different instructional approaches, must have time in the early weeks of course deliveries to familiarize students with their new tools and approaches, and create a comfort level which allows linked classrooms to operate in as transparent a manner as possible.

There is a direct correlation between learner success in an ITV environment, and adequate professional development for instructors being available before they begin to teach in linked classrooms.

Once you get used to talking on the system and seeing yourself close up on the big screen, it is not so bad. Having access to the guest speakers in three regions of the province was a real bonus, we would never had had that in a face-to-face class.

CAMPBELL RIVER STUDENT EVALUATION COMMENT
Supported Child Care ITV delivery 1999. North Island College/College of the Rockies/University of Victoria

Centralized registration and fee payment mechanisms A significant barrier to ITV course deliveries across provincial regions, or across sectoral boundaries between K–12, college and university partners, is the lack of a centralized entry point through which students can register and pay fees. In one instance, a course offered between a college, a university-college, and a university had three separate fee levels, three different requirements for instructional hours, and three different credit mechanisms [University of Victoria, Promoting Positive Outcomes pilot delivery, 1998].

A working model for cross-institutional registration already exists for distance education, which could be adapted to meet the required needs. The Open Learning Agency's registration system allows students from five universities to register and pay fees through OLA, and has been used effectively for over ten years. Fees are returned to host institutions at the end of course terms. It has facilitated increased access for learners while eliminating the duplication and confusion caused by differences in models and policies at several institutions.

Instructor Issues

The Need for Modified Teaching and Learning Approaches Instructional approaches for interactive videoconferencing environments need to be adapted from face to face classroom methods, if they are to be effective (Dolan and Forer, UVIC/UCFV ITV pilot, 1996; Christine Knupp Sorenson, Iowa State University ICN evaluation, 1995). Lecture-style deliveries with instructor requests for comments or questions, when viewed on a medium-size video monitor with a compressed visual signal and delayed audio, challenge even the most focused learner's attention span and capacity to absorb information.

Learners in some source-site ITV classrooms also indicate higher levels of perceived disenfranchisement, or lack of access to their instructor, compared to traditional classroom delivery where they are the sole focus of the instructor's attention. Effective instructional techniques include cross-site small-group assignments and projects which promote learner interactivity.

Educational Considerations—Recommendations

5.1 The 1999 FTE Funding Formula review currently being undertaken by the Ministry of Advanced Education, Training and Technology; and the RFP process for Career Technical Centres in non-urban regions of the province through the Ministry of Education; consider this report in their deliberations, and assign weighted funding variables for rural region connectivity in their redesigned FTE formulae by April, 2000 from Ministry base budgets.

5.2 The Ministries of Education, and Advanced Education, Training and Technology, be approached by the Provincial Learning Network Implementation team and EDS Systemhouse, with a proposal for developing an enhanced print/video/web-based resource for ITV learners by September, 2000 within the PLN Help Desk mandate. This resource would be a companion to the ITV instructors orientation guide and video which was developed in 1996, available through the C2T2.

I am married, a mother of 2, and I recently decided to return to school to continue my education. The ITV courses I have taken have been instrumental in helping me achieve my academic goals. The two-way interaction allows me to feel like I am sitting there in front of a professor, that my absence would be noticed and missed. It encourages me to attend and keep up.

North Island College Student
Port Hardy, 1999

5.3 The Ministry of Advanced Education, Training and Technology, and the Ministry of Education, expand the mandates of the Open School and Open Learning Agency, to become central registration and fees clearinghouses for K–12 and post-secondary interactive videoconferencing deliveries crossing regions and sectors, by April 2001 within program base budgets.

5.4 That the Centre for Curriculum, Transfer and Technology, in partnership with the Open School, apply for Office of Learning Technologies funding to further develop the ITV resources sections of the C2T2 and MOE Videoconferencing web sites to include mini-workshops on effective ITV instructional strategies, by September 1, 2000. Regular updates to these resources will be announced to the secondary and post-secondary systems through relevant email lists, scheduled professional development activities, and conferences.

NB. This recommendation fits with the C2T2 1999 Strategic Directions document, and will enable more K–12 teachers to develop ITV teaching knowledge and skills as sites become available with PLN rollout across the province.

5.5 The Ministry of Advanced Education, Training and Technology and the Centre for Curriculum, Transfer and Technology develop a special initiative grant that incorporates educational technologies as a teaching strategy.

Section 6 A Vision for ITV in British Columbia

September, 2001. Kelly Greenwood, an instructor at the Career Technical Centre at the University-College of the Cariboo in Kamloops, is demonstrating an advanced joinery technique in a secondary wood processing program. Groups of grade 11 and 12 students in linked classrooms in Abbotsford in the Fraser Valley, and Port Alberni on Vancouver Island, look at a camera close-up of the dado cut which has just been made in a piece of second-growth Douglas fir. The project is a garden furniture suite designed for international export.

The three rooms are connected by IP-based videoconferencing at 384kbps. Algorithms have progressed to the point where there is minimal image smearing when Kelly moves around the classroom, and there is no delay between the audio signals and the visuals.

The instructor uses a switch on a document camera to change the signal going to television monitors in the three classrooms, and brings up a CAD presentation on a laptop. She explains the mathematical formula used to determine the angles used for the cuts, and shows how the joins will be made.

Harold Lui, a Nuu-Chah-Nulth student from Pt. Alberni, asks a question. The instructor asks Bonnie Angstadt, a student from Mission, to explain to the class how she managed the process Harold is asking about. Bonnie uses an electronic whiteboard to roughly sketch how she approached the problem, and why she made the choices she did. Harold thanks her, and later uses her approach successfully in his self-paced quiz. His final assignment for the course will be a group presentation to the class, with partners in each of the other sites.

John Rolph is registered in the course as an online student, from Bella Coola. John does not have access to an ITV classroom, but his local college Learning Centre has a computer classroom connected to the Provincial Learning Network. John connects to the class via streaming video. He is able to watch and hear the students at the videoconferencing sites in a window on his computer desktop. John uses software on the computer to send a question to the instructor with a feature similar to online chat. Kelly sees the question come up on her monitor, repeats it so her ITV learners know what John has asked, and flips to a page in a course manual. She places the manual on the document camera, switches its output to send a picture of the page to all sites and the streaming video output, and answers John's question for the class using the diagram on the page for illustration.

The 22 students in the three sites have registered in this course through a provincial registration system operated by the Open Learning Agency. Their FTEs are counted by the colleges and high schools where they attend class. Program funding is provided through a shared formula developed collaboratively by the Education and Advanced Education ministries.

This scenario, or a facsimile of it, is already operating successfully in jurisdictions like Oregon, North Carolina, New Brunswick, and Iowa. For British Columbia to take full advantage of the videoconferencing opportunities offered by the Provincial Learning Network, connectivity and interoperability issues must be addressed and new delivery methods must be adopted. Systemic barriers to collaboration must continue to be identified and overcome, and instructional models altered to best serve the needs of a changing population of learners.

The critical challenges to be met in making the above scenario a reality include:

- Adequate bandwidth on demand
- Upgrading of hubs, routers and network components to guarantee system integrity
- Standardized equipment purchase and upgrading
- Classroom design and configuration standardization, to make base-level participation possible from all sites in the network
- Professional development for instructors which is required before the first offering of an ITV class.

When these challenges have been faced and partnered educational programs are offered across provincial regions, schools and institutions, the promise of a provincial "learning network" will be several steps closer to realization. Sharing funding, institutional resources and program development functions will require significant shifts in how secondary and post-secondary sectors currently operate. In five short years since 1995, the Internet has revolutionized educational communication. As interactive videoconferencing moves onto the Internet, learner access to the province's educational assets can take a major leap forward.

APPENDIX I

Terms and Definitions

ADSL: Asynchronous Digital Subscriber Line. A high-speed form of connectivity offered by Telus in some parts of the province.

Bridge: a device which makes it possible for more than two ITV sources to interact with each other.

Cable Modem: a device which enables computer users to access the internet using a cable television connection, at speeds up to one hundred times that of a conventional telephone modem.

Connectivity: the capacity of videoconferencing systems at different sites to be linked in order to create a network.

Gateway: a device which makes it possible for videoconferencing systems operating on different protocols to be connected with each other.

Interoperability: the extent to which the operation of ITV systems can be coordinated in a way that enables users to interact successfully with one another.

IP: Internet Protocol short form of TCP/IP or Transmission Control Protocol/Internet Protocol. For the purposes of this report IP-based ITV is videoconferencing over the Internet.

ISDN: Abbreviation of Integrated Services Digital Network. A standard for transmitting digital data over standard telephone lines.

ITU-TH.320: International Telecommunications Union – Telecommunications standardization sector—H.320 protocol for transmission of compressed video signals over switched data circuits. Also abbreviated as H.320.

ITU-TH.323: International Telecommunications Union – Telecommunications standardization sector—H.323 protocol for transmission of compressed video signals over TCP/IP routes. Also abbreviated as H.323.

ITV: Acronym for interactive videoconferencing.

Protocol: a standard procedure for regulating data transmission between computers

Push to talk: an audio configuration in a videoconferencing room where microphones are used for communicating between sites by pushing a talk button. In some ITV systems, pushing the microphone button also keys the camera to zoom in and focus on the speakers in that zone.

Standards-based: a developmental approach to network building which assumes adherence to certain accepted protocols established by international convention, as opposed to selection of a single vendor's or group of vendors' products.

Sw56: Switched 56Kilobit, a digital data service offered by telephone carriers. Sw56 allows for dialup data service similar to ISDN.

Ubiquity: a brand name for full-motion videoconferencing service, first offered by BC Tel in 1995, over its fibre-optic network.

APPENDIX II

Relevant Annotated URLs

Instructional

C2T2 Resource page—http://www.ctt.bc.ca/edtech/videoresources.html

Other resources

http://malun1.mala.bc.ca/seeds/ivc/Design.html
Design and Presentation of ITV classes

http://www.ind.net/distance_ed/ipse/fdhandbook/uiv.html
Using Interactive Video for Instruction

http://www.syllabus.com/jan99_magfea3.html
Using Video Conferencing Technology in Teaching

http://labs.nwacc.cc.ar.us/disted/nwdetciv.htm
This outline is designed to inform the user about the basic elements of Compressed Interactive Video Presenting and Teaching

http://www.kn.pacbell.com/wired/pubs/vidconf_guide.pdf
The outline is designed to inform the user about the basic elements of Compressed Interactive Video Presenting and Teaching

http://www2.tvo.org/education/resources/vidconf/vidconf.html
Organizing a videoconference

http://www.kn.pacbell.com/wired/vidconf/Using.html
An introduction to using videoconferencing technology for teaching

http://www.howent.com/lookgood.html
With the advent of desktop videoconferencing (DVC), it will be necessary for ordinary professionals to become visually literate. Considerations given to the choice of equipment, picture composition, camera technique, lighting system, appropriate background, good audio clarity, suitable wardrobe and makeup approach will promote visual literacy and effective videoconferencing.

http://cause-www.niss.ac.uk/ir/library/html/cem9915.html
Good Teaching Is Good Teaching: An Emerging Set of Guiding Principles and Practices for the Design and Development of Distance Education

Satellite

http://www.uwex.edu/disted/satellite/index.html
An overview of videoconferencing with satellite links: pros, cons, methodologies

Technical

Telus ADSL site

http://www.cs.ubc.ca/spider/mjmccut/broadband.html#adsl
Telco Access - ADSL (Asymmetric Digital Subscriber Line)

http://www.bctel.ca/multimediagateway/
Your high-speed gateway to the Internet

Scaling Bridges for IP

http://www.picturetel.com/products/pt240p.htm and

http://www.picturetel.com/products/pt330p.htm
PictureTel videoconferencing products

Audio

http://www.audioideas.on.ca/
Audio Ideas Guide online

http://www.andrew.cmu.edu/~zu22/html/music/Audioinfo.html
Audio Related Internet World Wide Web & FTP Sites

Streaming Video

http://www.real.com/
Realmedia website, streaming video clients and servers

http://www.apple.com/quicktime/
Apple Quicktime website, streaming video clients and servers

http://www.polycom.com/products/video/stream_station/index.htm
Polycom streaming video server information

http://www.picturetel.com/products/starcast.htm
PictureTel streaming video server

Echo Cancellation

http://ellmer.netmegs.com/dtaf.html
Echo cancellation and noise suppression

http://www.hdot320.com/echo.htm
Acoustic Echo Cancellation

http://utelnt.el.utwente.nl/links/schurer/wk.html
Adaptive acoustic echo cancellation to improve speech intelligibility in large reverberating rooms"

Videoconferencing

http://www.psu.edu/dept/cac/infotech/video.html
Links to information about videoconferencing

http://www.kn.pacbell.com/wired/vidconf/glossary.html
A videoconferencing glossary

http://hepnts1.rl.ac.uk/SYSMAN/may98/vcfayers/tsld001.htm
Videoconferencing: A Scenic Tour of Current Technologies

The Videocon e-mailing list is oriented to technical issues and higher education. To subscribe, send a subscription request (SUBSCRIBE YourFirstName YourLastName) to the list address (LISTSERV@ASUVM.INRE.ASU.EDU)

H.320

http://www.micta.org/techdocs/h320primer/tsld001.htm
An overview of the H.320 protocol and its applications in videoconferencing

http://bugs.wpi.edu:8080/EE535/hwk97/hwk4cd97/bigles/bigles.html
An exploration of the H.320 protocol and its applications

H.323

http://www.intel.com/proshare/conferencing/h323/whatis.htm
What is H.323?

http://www.micta.org/techdocs/h323primer/
A primer on H.323

http://standards.pictel.com/reference/9706_itca_h323/index.htm
More technical information on H.323, terminals, gateways, and networks

Administrative

http://www.bced.gov.bc.ca/vidcon/
MOE site—ITV scheduling options

http://www.col.org/col.htm
Commonwealth of Learning

Policy

http://www.aett.gov.bc.ca/strategic/
Charting a New Course—the strategic plan for British Columbia's college, institute and agency sector, published in 1996

http://www.ctt.bc.ca/edtech/policy/toc.html

Policy Forum—Report of the Policy Forum on Distributed Learning Environments, September 1995. An overview of issues confronting public post-secondary institutions as they move toward a networked learning model

http://www.ctt.bc.ca/edtech/DLTF/index.html

Access and Choice—Report of the working group tasked with implementing the Policy Forum's recommendations. Operational overview of key issues, and recommendations for addressing them.

http://www.aett.gov.bc.ca/strategic/edtech/welcome.htm

ETWG framework—Draft policy framework [1999] developed by a working group of the B.C. Ministry of Advanced Education, Training and Technology to address the education technology directives in Charting a New Course.

http://www.sfu.ca/tpi/cmec.htm

Telelearning Policy Initiative—Policy site established by the Telelearning Centres of Excellence project to address distributed learning issues.

APPENDIX III

Questions and Responses

Survey of Video Conferencing in BC, April 1999

1. Response Summary

Twenty eight surveys were distributed to the public post-secondary system including the colleges, institutes, the Open Learning Agency, and the universities. Twenty responses were received giving a 71% response rate.

The following institutions responded to the survey:
Camosun College, College of the Rockies, Douglas College, Institute of Indigenous Government, Justice Institute of B.C., Kwantlen University College, Langara College, Malaspina University-College, Nicola Valley Institute of Technology, North Island College, Northern Lights College, Northwest Community College, Okanagan University College, Open Learning Agency, Selkirk College, Technical University of BC, University College of the Cariboo, University of British Columbia and the University of Victoria.

The representatives who responded to the survey were primarily administrators responsible for educational technology, distributed learning and/or media services.

The following institutions did not respond: BCIT, Capilano College, College of New Caledonia, Emily Carr Institute of Art and Design, Royal Roads University, Simon Fraser University, University College of the Fraser Valley and Vancouver Community College.

2a. What type of video conferencing equipment does your institution own?

Facilities-based: 12

Desktop-based: 9
(Includes 5 institutions reporting both facilities and desktop)

Rented desktop-based on occasion: 1

None: 5

2b. What type of protocols are used for video conferencing at your institution?

Ubiquity: 6

ISDN: 9

Switched 56K: 6

IP (through the Internet or PLNet): 9

Other: Shaw Cable = 1; Ocnl Fiber loop =1, DS-1 Direct Connect = 1.

Comments: 9 institutions use more than 1 type of protocol.

Overview:

	Facilities based	Desktop based	None	Ubiquity	ISDN	556k	IP	Other
Camosun*	yes				yes		yes	
CoTR	yes					yes		
Douglas	yes				yes	yes		DS-1 Direct Connect
IIG		Yes					Yes	
JI	yes			yes				
KUC			None					
Langara		rented			yes			
Malaspina		Yes			yes	yes	yes	
NIC	yes	Yes			yes	yes	yes	
NLC			None					
NWCC			None					

	Facilities based	Desktop based	None	Ubiquity	ISDN	S56k	IP	Other
NVIT			None					
OUC*	yes							Cable
OLA	yes			yes	yes		yes	Ocnl Fiber Loop OLA ToC
Selkirk	yes	yes				yes	yes	
TUC		yes					yes	
UBC	yes	yes		yes	yes	yes	yes	
UCC	yes	yes		yes	yes			
UNBC	yes			yes				
UVIC	yes	yes		yes	yes	yes		

[Note: Camosun and OUC have just installed new equipment. Camosun has dropped Ubiquity and has opted for ISDN. OUC is installing Shaw Cable. They both answered yes to the above questions but had no data yet on usage for credit courses or for meetings.]

3. **If you answered None for #2a—is your institution planning to implement video conferencing in the future?**
Five institutions responded None to question 2a but eight responded to this question.

Three institutions plan to pilot in 99/00 or 00/01. Camosun (switched from Ubiquity to ISDN – Spring '99); Kwantlen, IIG.

NVIT plans to share facilities with UCC by 2001.

NLC doesn't know because of problems with northern telephone lines.

OUC is in the process of installing their cable system.

NWCC indicates video conferencing is in the plans but has no date yet for implementation.

Langara has no plans to implement video conferencing.

CREDIT COURSES

4. **On average how many Courses are delivered using video conferencing per semester? Note: Consider all credit courses delivered from all/any of your campuses. Count in courses that are delivered via mixed mode, e.g., video conferencing with some other delivery method.**
Total response:
Nine institutions offer a total of 38.5 credit courses on average per semester.

NIC, UCC	2	7–10
Selkirk, UBC	2	4–6
CoTR, Doug, Mala, UNBC, UVic	5	1–3

5. **On average, how many hours per week do you use your video conferencing facilities for classes?**
Total response:
Ten institutions responded with a total of 107.5 hours per week. (*Note:* OLA did not respond to question 4 as it does not offer credit classes. However, it does use its facility to deliver Queen's MBA classes at 8 hours per week.)

NIC,UCC	2	25
CoTR, OLA, UBC, UVic	4	7–10
Doug, Mala, Selkirk, UNBC	4	4–6

6. **Typically for courses, how many sites do you connect to at one time?**
   Total response = 10
   On average they connect to 2 sites at one time: the home site and the remote site. A few connect to 3 or 4 sites at one time. OLA when delivering the Queen's MBA courses connects with 20 sites at once.

7. **On average, how many courses are delivered per semester to other institutions. Please list the institutions here.**
   Total response = 4
   On average BC institutions deliver to 3 other institutions. OLA connects with Queen's, University College of the Fraser Valley and a Community Skill Centre; UBC delivers classes to Mexico, Selkirk College, University of Manitoba; North Island College delivers to UVic, CoTR, NWCC and UCFV and Uvic connects with CoTR and NIC.

8. **In your best estimation, how many credit courses will be delivered via video conferencing in the Fall semester of 1999? Spring 2000? Fall 2000?**

[Fall 1998]	[Average 38.5] from Question 4 above
Fall 1999	50
Spring 2000	52
Summer 2000	56

9. **Other comments about delivering credit courses via video conferencing.**

   As LAN-based video conferencing becomes available our situation will change dramatically: student feedback is good.

   Use varies from semester to semester.

   Growth 9–10 courses per semester est.; The # of hours for credit courses is limited by the amount of technician's time available.

   If successful in generating significant volume of ongoing video conferencing activity [we] will quickly run into scheduling problems with our facilities-based system. Will setup conference calls for asynchronous online courses across campuses.

   With the exception of desktop video over IP, video conferencing is not a good option for our institution at this time.

   We find good success delivering credit courses with video conferencing supplemented with web-based delivery of materials, i.e., WebCT for all written materials, exams, assignments, email communications between students and technical communications between video conferencing presentations by instructors.

MEETINGS AND NON-CREDIT COURSES, ETC.

10. **On average, how many hours per week do you use your video conferencing facilities for meetings?**
    Total Response = 10
    Total hours per week = 110.

Doug, Selkirk	2	21–25
	0	16–20
CoTR, UBC	2	11–15
UVic	1	7–10
Mala, NIC, OLA, UCC	4	4–6
UNBC	1	1–3

Note: Meetings include everything that is not a credit course, e.g., interviews, meetings, non-credit courses, workshops, professional development, board meetings, etc. Consider all meetings from all/any of your campuses.

11. Typically for meetings, how many sites do you connect to at one time?
Most institutions connect point to point with the home and remote site.

12. Do most meetings take place within BC?
The colleges, institutes and the OLA generally conduct meetings within the Province of BC. The universities conduct meetings via video conferencing provincially, nationally and internationally.

GENERAL

13. Overall, in the last two years (1997/98 and 1998/99) have you seen an overall increase or a decrease in the use of video conferencing at your institution? If so, why?

Total Response = 14

Increase: 10

Decrease: 3

Neither: 2

(One response saw a decrease in courses and an increase in meetings.)

Comments:

Due to variable cost price structure of Ubiquity service used previously. Potential user comments indicate substantial demand.

Novelty worn off, clients purchased own equip; companies given over to operators

Opened 2 remote campuses

Complexity, cost, lack of Ubiquity sites

Just begun to use it

Technician's time for courses/ cuts to travel for increase

Used very little because of high cost of renting equipment and time

Cost and quality

Due to Queens MBA course

Government use; Professional Development use

Faculty/staff more aware of its potential the more they want to use it.

Fulltime position to support video conferencing; the Internet overshadowed video conferencing is now commonplace. As the Internet becomes more familiar people will rediscover video conferencing and its benefits. Each time I see someone use video conferencing for the first time, they usually become [a]regular

Companies interviewing students; defense of theses

Don't know

14. What future uses can you see for video conferencing technology?

Comments:

Video conferencing has major advantage over web courses: high degree of interactivity & ability to teach w/o heavy up front investment in courseware development make it suitable for high-value specialty areas where # of students may be very low or where curriculum must be highly tailored to specific student needs.

Distribute courses in region cost-effectively; cut travel costs; service businesses.

Student services.

Meetings and instruction.

Guest lectures, speakers.

Interviews (personnel, student), government meetings.

Tutorial support and seminars.

Lots of possibilities.

Meetings and course use.

PC to PC will increase dramatically; Picture Tel will remain about the same.

Desktop uses: unscheduled, unsupervised meetings of student workgroups; online seminars in small graduate classes, talk show model with larger classes.

As speed and quality increase I see desktop to small group usage increasing. Such things as counselling session, student interviews, desktop to desktop training.

Medical training to remote and rural areas; High interest sites with experts available for comment (i.e., NASA).

15. Do you use video conferencing with any of these types of institutions?

Total Response = 14. Four institutions do not use video conferencing to communicate with these types of agencies. The main use is to communicate with BC Government Ministries and with the Federal Government.

Libraries	2
Ministries (BC)	10
Federal Agencies	7
Museums (BC)	1

16. What is the main obstacle in terms of using video conferencing? What are some recommendations for resolving this situation?

Obstacles:

Cost of telecommunications, small group sizes (difficulty in aggregating students), availability of access sites (both the # of communities with v/c sites, and to move equipment around within institutions).

Cost, fear and lack of understanding in business community.

Line costs.

Ministry doesn't provide capital dollars for IT or ET.

Complexity.

Cost of setting up compared to anticipated use.

Capital funding; monthly line rentals.

Quality, speed, bandwidth and reliable connections.

Time and money.

Quality of phone lines.

Province-wide system with same protocols, cost is s email and web traffic to institutions.

Limited, and site based video conference locations.

Cost for deploying conventional video conference; conventional video conference tends to reproduce lecture model; and, does not support cooperative learning; tends to privilege one site (the one with the instructor) over others.

Reaching smaller locations who suffer from lack of basic services. How can we expect the clients there to become viable educated residents if they are expected to uproot their lives to attend school.

Expense - ISDN line costs.

Cost, fear of users, quality of connections.

Solutions:

A strategy from PLN about v/c over IP would be a great help.

PLN should stop stalling & cover our costs for a PRI line.

Need more incorporation into classroom - new ISDN technology will support this, with portable units rather than specialized suites.

Good quality IP vide using the Internet, voice-seeking cameras to reduce setup costs.

Yes in the past.

Time constrained by laws of universe; need more technicians' time for f2f lecture format.

PLN set up in North.

Recommend more desktop systems.

Exploit desktop video wherever appropriate.

None.

17. Do you use video conferencing for learner support? (e.g., counseling, advising, financial aid) If yes, please describe the type of learner support delivered via video conferencing.

Total Response = 13

Yes = 8

No = 3

Planned = 2

Types of learner support:

Most of our students attend one of the campuses where they can get learner support.

Advising and counselling between campuses

Tutoring/remedial assistance

Learner support; guest lecturer

Moving to counselling, advising and financial aid via desktop

Cost and priorities on facilities. Student support would be lost use for instructional use

Disability Services use some limited desktop vconf to counsel students

Netmeeting for Instructor/student conferences. Students may not get video due to lack of video cams but will have to get by with audio, text and whiteboard, etc.

Counselling, student interviews, training sessions

Eyewitness testimonials with cross examinations

Learning Resource has connected with students in Quesnel & Williams Lake

Co-op job interviews

18. Are your credit courses that are delivered via video conferencing or mixed mode listed in the Distributed Learning Course Directory <dlcd.ctt.bc.ca>?

Total Response = 12

Yes = 2

No = 7

Not currently = 1

Don't know = 1

19. Other comments?

Response reflects September–March.

Video conferencing drops in summer time.

Want to experiment with desktop this year.

Major concern is capital expense of the equipment and the costs of maintaining the leased lines.

Single campus, no interest by faculty to share courses with other institutions.